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1CAN071801

July 13, 2018

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Subject: Licensee Event Report 50-313/2018-001-00
Arkansas Nuclear One, Unit 1
Docket No. 50-313
License No. DPR-51

Dear Sir or Madam:

Pursuant to the reporting requirements of 10 CFR 50.73, attached is the subject Licensee Event Report concerning the automatic reactor trip due to loss of main feedwater for Arkansas Nuclear One, Unit 1.

There are no new commitments contained in this submittal.

Should you have any questions concerning this issue, please contact me, at 479-858-4704.

Sincerely,

ORIGINAL SIGNED BY STEPHENIE L. PYLE

SLP/rwc

Attachment: Licensee Event Report 50-313/2018-001-00

cc: Mr. Kriss Kennedy
Regional Administrator
U. S. Nuclear Regulatory Commission
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NRC FORM 366 (04-2017) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 03/31/2020

LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

(See NUREG-1022, R.3 for instruction and guidance for completing this form http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Arkansas Nuclear One – Unit 1	05000313	1 OF 6

4. TITLE Automatic Reactor Trip due to Loss of Main Feedwater Pump

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									N/A	
05	16	2018	2018	001	00	07	13	2018	FACILITY NAME	DOCKET NUMBER
									N/A	

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*			
1	☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
10. POWER LEVEL	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
~ 10%	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(1)
	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(2)(i)
	☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(ii)
		☐ 50.73(a)(2)(i)(C)	☐ OTHER Specify in Abstract below or in NRC Form 366A	

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT	TELEPHONE NUMBER *(Include Area Code)*
Stephenie L. Pyle, Manager, Regulatory Assurance	479 858-4704

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO				

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

During the Arkansas Nuclear One, Unit 1 (ANO-1) startup from refueling outage 1R27 at ~1750 CDT on May 16, 2018, the reactor experienced an automatic reactor trip from approximately 10 percent power due to a Reactor Protection System (RPS) trip from a loss of main feedwater as a result of a trip of the "B" Main Feedwater Pump (MFP) due to operator error. The "A" MFP was not in operation at the time. The ANO-1 Control Room was in the process of raising reactor power to a band of 12 – 15% when the MFP tripped on high discharge pressure.

The MFP trip resulted in a RPS actuation (reactor trip) followed by an Emergency Feedwater actuation. All control rods inserted into the core and the reactor was verified shutdown.

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Arkansas Nuclear One, Unit 1	05000-313	2018	001	00

NARRATIVE

A. PLANT STATUS

On May 16, 2018, Arkansas Nuclear One, Unit 1 (ANO-1) was performing a plant startup and power escalation following the refueling outage 1R27. Reactor power was approximately 10 percent of rated thermal power (RTP) and was planned to be raised to 12 – 15% RTP. There were no other structures, systems, or components (SSCs) that were inoperable at the time that contributed to the event.

B. BACKGROUND

Main Feedwater Pump Speed Control System

The MFP Speed Control System positions the MFP turbine high or low pressure steam admission valves to control speed in response to a demand from either the Integrated Control System (ICS) or the control board operator. The control system maintains the turbine speed within a required band. The control system also provides the operators with indications and alarms associated with turbine performance.

During normal operation, ICS demand is used for MFP control. The Operator Control Station (OCS) allows the control board operator to control the MFP in AUTO using an ICS signal or independently of ICS in either a manual or direct governor mode where the operators control the MFP from the OCS. An Operations Interface Touchscreen (OIT) is also provided. The OIT displays turbine control and alarm system information.

The MFP Control System features a discharge pressure limiter. The high discharge pressure limiter reduces governor module demand output upon reaching 1275 pounds per square inch – gauge (psig). This results in a discharge pressure setback. Approximately 10 seconds after MFP discharge pressure is lowered below 1275 psig, the governor module is released to ICS control.

The MFP protective circuits require two of three signals for a discharge pressure setback or trip on discharge pressure. If the discharge pressure is sensed at greater than 1275 psig on the discharge pressure transmitters, then the turbine speed will automatically be reduced. If MFP discharge pressure is sensed greater than 1350 psig by two pressure devices, the MFP will trip.

C. DESCRIPTION OF EVENT

On May 16, 2018, ANO-1 reactor and plant startup from 1R27 was in progress. At ~1750 CDT the ANO-1 reactor experienced an automatic reactor trip from approximately 10 percent RTP due to a RPS trip from a loss of main feedwater. The loss of main feedwater was a result of a trip of the "B" MFP. The Control Room was in the process of raising reactor power to a band of 12 – 15% RTP when the "B" MFP tripped on high discharge pressure.

The procedure in use included a continuous action step to control MFP discharge pressure within a specified band. The procedure also identified two plant computer points for the "B" MFP discharge pressure as having sufficient upper range for proper discharge pressure monitoring. The At-The-Controls (ATC) operator received the pressure band in which the MFP was to be operated from the Control Room Supervisor (CRS) and documented the values on a placard by the MFP controller.

The associated computer points were also displayed on a computer screen for ease of monitoring. The computer points were displayed as a single point vice being displayed as a trend. The ATC noted that the computer points were reading ~1100 psig. During adjustments, the computer points for "B" MFP stopped responding and were "locked up". Subsequently, the ATC utilized a discharge pressure indication on the "B" MFP OIT that was determined to be functioning correctly.

Actual discharge pressure reached the high discharge pressure setback setpoint of 1275 psig, which automatically reduced pump speed (setback) and then released once discharge pressure was less than 1275 psig for 10 seconds. This happened three times; however, "B" MFP demand continued to be raised by the ATC because it was not recognized the MFP reduction in speed was being caused by a high discharge pressure setback. The final time the high discharge pressure setback was released; the pump discharge pressure reached the high discharge pressure trip setpoint of 1350 psig which caused the pump to trip. The MFP trip resulted in a RPS actuation (reactor trip) followed by an Emergency Feedwater (EFW) actuation. All control rods inserted into the core and the reactor was verified shutdown.

The Reactor Trip Emergency Operating Procedure (EOP) was entered and transitioned to the Overcooling EOP based on low steam generator pressures. Overcooling was due to auxiliary steam loads in excess of the actual decay heat load and was terminated by transferring auxiliary steam loads to the station startup boiler. The plant was placed in a stable condition using EFW.

D. EVENT CAUSES

The direct cause of this event was determined to be that the ANO-1 Control Room team did not recognize "B" MFP discharge pressure was being operated outside of band.

The root cause of this event was that a station procedure did not identify "B" MFP discharge pressure as a critical parameter in accordance with an Entergy fleet procedure. On the day of this event, the control room team did not establish a monitoring method or monitoring frequency for this parameter.

An Entergy fleet procedure defines a critical parameter as any parameter that the CRS has determined will merit heightened awareness and will require a specific response from the crew or plant systems at a certain parameter value such as:

- Parameter not under the normal control of automatic systems
- Parameter not being controlled in the expected band by automatic systems
- Parameters not being maintained in the expected band due to a plant transient or degraded equipment.

With respect to the subject event, the MFP discharge pressure should have been identified as a critical parameter as it was being manually controlled when typically operated in automatic. Identifying the discharge pressure as a critical parameter would require the team to perform the following:

- Operator assigned to monitor parameter
- Monitoring method
- Monitoring frequency
- Action limit / band
- Compensatory actions to be taken

The contributing cause for this event was determined to be ANO-1 Operations management and crew leaders did not effectively meet expectations of providing optimal crew composition, maintain command and control, and oversee control room evolutions.

The following factors were identified through the various analysis techniques used to be related to the root and contributing causes associated with this event.

- Crew Composition

  The scheduled on duty CRS had called in sick prior to the watch and a relief CRS assumed the watch who was subsequently designated as the team lead for placing the MFP in service. A Shift Manager (SM) supporting activities assumed the CRS role for oversight. The SM had not been involved with the Just In Time Training (JITT) for the startup and had not served in the CRS role in approximately one year. In addition, the dayshift Shift Technical Advisor (STA) was relieved at 1600 for personal reasons and was replaced by an STA that had not attended JITT.

- Command and Control

  The CRS did not challenge the basis of why the procedurally identified computer points were out of band or the ATC's alternate monitoring method of using the OIT discharge pressure while manually operating the MFP.

  The ATC extrapolated the differences between the two indications and assumed that as long as the monitored indications remained constant then discharge pressure was being controlled within the appropriate band per the earlier identified OIT indication.

  The ATC did not communicate with the CRS or anyone on the crew that the computer display would be monitored to ensure that the discharge pressure remained within the acceptable band.

  The Control Board Operator – Turbine (CBOT) performed a component verification versus a peer check as required by ANO Operations standards.

- Procedure use and Adherence / Procedure Compliance

  Throughout the course of the shift, there were multiple examples of the ANO-1 Control Room team failing to implement administrative procedural requirements outlined in station and fleet procedure intended to minimize the potential for human error.

- Formal Operations Communications

  Crew members (other than the ATC) were unaware of the failed pressure instrument which impacted the team's ability to challenge pressure monitoring and control. The CRS did not request updates from the ATC during the evolution regarding MFP discharge pressure.

- Operator Knowledge and Training

  ATC operator did not identify that the setback feature was active which led to the raising of MFP speed to "control" RCS pressure. As stated previously, several members of the crew did not attend JITT.

A performance analysis was conducted for the conceptual error on the part of the ATC regarding system operation. Based on the review in the analysis, no training weaknesses were identified. The evaluation determined that the evolution had been correctly performed in the past without identifying MFP discharge pressure as a critical parameter, the activity was not overly complex, and successful performance was within the fundamental skills and knowledge of a typical ATC.

E. CORRECTIVE ACTIONS

The appropriate station procedures will be revised to clearly delineate the MFP discharge pressure band as a critical parameter per the fleet procedure.

Other corrective actions include a revision to the startup just-in-time-training, expansion of knowledge objectives for low power feedwater control; and the communication of behavior gaps identified.

The issue of the ATC and CRS not demonstrating Operations fundamentals was addressed through the Entergy Performance Management Process.

F. SAFETY CONSEQUENCES

The actual consequences of this event were "B" MFP trip and automatic reactor scram. Low decay levels as a result of the event following initial startup from a refueling outage required Operators to transfer auxiliary steam loads to the station startup boiler post-trip in order to limit cooldown of the Reactor Coolant System. There were no other actual consequences to general safety of the public, nuclear safety, industrial safety or radiological safety due to this event.

G. BASIS FOR REPORTIBILITY

This event is reportable pursuant to the following criteria:

10 CFR 50.73(a)(2)(iv)(A)	Any event or condition that resulted in manual or automatic actuation of any of the systems listed in paragraph (a)(2)(iv)(B) of this section. Paragraph (B)(1) lists "Reactor protection system (RPS) including: reactor scram or reactor trip". Paragraph (B)(6) states "PWR auxiliary or emergency feedwater system".

The guidance provided in NUREG 1022 states under 10 CFR 50.73(a)(1):

> *The holder of an operating license for a nuclear power plant (licensee) shall submit a Licensee Event Report (LER) for any event of the type described in this paragraph within 60 days after the discovery of the event.*

H. ADDITIONAL INFORMATION

10 CFR 50.73(b)(5) states that this report shall contain reference to "any previous similar events at the same plant that are known to the licensee." NUREG 1022 reporting guidance states that term "previous occurrences" should include previous events or conditions that involved the same underlying concern or reason as this event, such as the same root cause, failure, or sequence of events.

A review of the ANO corrective action program and LERs for the previous three years was performed. One event was identified (see LER 50-313/2015-001-00) (ML16043A253). This is an ANO-1 event that occurred at 48% RTP during a power reduction to support main turbine Electro-Hydraulic system repairs.

There was a malfunction of a main feedwater valve controlling flow to the steam generator and the response by the crew to address the ICS control issue did not take into account the interlocks with the other feedwater flow control valve. This was a result of procedural inadequacies to address ICS malfunction. The ICS abnormal operating procedure is used to address instrumentation failures and not failures similar to those identified in this condition report.

A relevant causal factor to this event was an invalided assumption in the crew's mindset that the slow response of the low level control valve was due to a failed valve instead of by design with the air operated valve dead band response.

Corrective action relevant to addressing the inadequate mindset included revising the ICS procedure to contain additional guidance regarding dead band response.

This OE is applicable as it relates to manual control of components that predominately are operated in automatic and that incorrect mindsets in relation to manual operations of these types of plant components can lead to wrong assumptions in operations.

Energy Industry Identification System (EIIS) codes and component codes are identified in the text of this report as [XX].